

size the breadth of associations of mediastinitis, in particular to add to the recognition of the link between vasculitis, cardiac tamponade, and superior vena caval obstruction.

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Home Treatment of Calf Deep Venous Thrombosis

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TRADITIONAL THERAPY in the United States for deep venous thrombosis confined to the calf involves seven to ten days of stay in hospital, but British practice advocates only three days.¹ Recent Canadian experience advocates five days of

hospital stay to begin anticoagulant treatment.² An otherwise healthy 37-year-old man was successfully treated at home for seven days with a continuous intravenous infusion of heparin. There were no complications during or following treatment, and the patient recovered uneventfully. Cost savings of approximately \$4,000 were realized by avoiding admission to hospital.

Report of a Case

The patient, a 37-year-old healthy, nonsmoking, male graduate student, was referred to our family practice clinic for the evaluation of left lower leg pain of a week's duration. His history did not reveal trauma, overexertion, periods of prolonged immobility, or a surgical procedure. He had, however, been admitted to hospital 15 years ago for bilateral thrombophlebitis of the upper legs. He suffered no sequelae from this episode and had had no medical problems until now.

On physical examination, his left calf was exquisitely tender with a positive Homan's sign. Superficial varicose veins were noted on the posterior aspects of both legs. The left calf was without erythema or swelling and did not appear excessively warm to touch. Calf diameter measurements were equal. Femoral, dorsalis pedis, and posterior tibialis pulses were strong and equal bilaterally. The lungs were clear to auscultation, and the heart was normal.

A Doppler ultrasonogram of the left leg revealed the paired peroneal veins in the left calf to be thrombosed. The thrombosis was confined to the peroneal veins. A diagnosis of deep venous thrombosis of the left calf was made. The patient was determined to be a good candidate for outpatient therapy and was willing to try it (Table 1). A home infusion therapy company (New England Critical Care, Westboro, Massachusetts) was contacted to arrange treatment. The initial home nursing visit consisted of a physical assessment; baseline prothrombin time, partial thromboplastin time, and complete blood count; and patient education. Potential problems and side effects related to deep venous thrombosis and anticoagulation therapy were discussed with the patient. After obtaining signed, informed consent, we established venous access in a peripheral vein, and a portable controlled infusion device (Pharmacia Deltec CADD-1) was attached for anticoagulation therapy. Heparin therapy was initiated with a 5,000-unit bolus, followed by 1,000 units per hour by continuous intravenous infusion. Oral anticoagulant medication—warfarin sodium, 10 mg once a day—was also started simultaneously. The nurse made twice-a-day visits to the patient's home to monitor progress and obtain blood specimens.

The laboratory results were reported to the physician, and appropriate changes in heparin dosage were made to keep the partial thromboplastin time between 1.5 and 2.0 times the control value. Similarly, the warfarin dosage was adjusted to keep the prothrombin time in the accepted therapeutic range of 1.2 to 1.5 times the control value.

The patient completed seven days of therapy in this manner. Clear lines of communication between the home infusion therapy team and the attending physician were maintained. The patient's venous access remained patent and without inflammation throughout treatment. He had no adverse effects from heparin and fully recovered from his calf vein thrombosis. Maintenance warfarin therapy was continued for three months with periodic monitoring at the clinic to

(Callister CB, Wood SD, White GL Jr, Tucker ED: Home treatment of calf deep venous thrombosis. *West J Med* 1991 Sep; 155:299-300)

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TABLE 1.—Selection Criteria for Home Infusion Therapy Using Heparin for Calf Deep Venous Thrombosis (DVT)

Acceptance Criteria	Contraindications
Patient reliability Suitable home environment Electricity, running water, and a clean living space Access to emergency medical services Appropriate space for infusion supplies Lives within a reasonable distance of home health nurses and emergency medical services Able to care for self, and another competent care person is in the home Normal cardiopulmonary function Documentation of isolated calf DVT Patient preference for outpatient regimen Consistent intravenous access	Intracranial neoplasm Other malignant neoplasms Stroke within 2 months Active bleeding (any source) Preexisting hemorrhagic disease Recent operation History of alcoholism or liver disease

TABLE 2.—Cost of Home Treatment Versus Hospital Treatment of Calf Deep Venous Thrombosis

Treatment Option	Length of Treatment, d	Daily Rate, \$	Completed, \$
Home therapy	7	263	1,841
Inpatient*	7	832	5,824
DRG code 131	6	455	2,732
DRG = diagnosis-related group			
*University hospital.			

assure that his prothrombin time was in the therapeutic range. A follow-up Doppler ultrasonogram was not done.

Discussion

This report illustrates the use of home infusion therapy for the treatment of deep venous thrombosis confined to the calf as an option to hospital admission in carefully selected, otherwise healthy patients. Patients with underlying disease or risk factors contraindicating anticoagulant therapy are not candidates for this treatment option.^{2,3} Because some below-the-knee thrombi might embolize before therapy, a lung scan should be considered. Patients with positive lung scans should not be treated at home.

The treatment of deep venous thrombosis below the knee varies from full anticoagulation for seven to ten days to simply observing a patient with noninvasive tests, treating only those patients whose thrombi propagate proximally.^{3,4} Serial impedance plethysmography (IPG) monitoring without therapy is one such approach.⁴ In the United States, anticoagulation therapy in a hospital setting has been the traditional and accepted norm.^{1,4} In Europe, however, home treatment using subcutaneous heparin has been successfully implemented.⁵ Regardless of the route of heparin administration, it is important to define objectively the location of the thrombus. Venography and IPG are superior to Doppler ultrasonography in diagnosing calf deep venous thrombosis.

The frequency of pulmonary emboli originating from isolated calf deep venous thrombi is controversial.^{4,6} One small, retrospective study without controls showed that 13% of cases of fatal pulmonary emboli originated in the calf.⁶ Other studies have shown that the incidence of fatal pulmonary emboli from a distal deep venous thrombus is low.^{3,4} Philbrick and Becker thoroughly reviewed the literature regarding this disorder, which can be extrapolated to provide the basic rationale for home treatment.³ Calf deep venous thrombi extend proximally to the thigh in about 10% of

symptomatic patients. This propagation occurs before embolization. No fatal emboli were reported in patients with deep venous thrombosis confined to the calf.³ Traditional anticoagulation treatment with heparin and warfarin for symptomatic patients with calf thrombi prevents extension, embolization, and early recurrence.

Pulmonary emboli and the risks of bleeding from heparin therapy are valid concerns when treating calf deep venous thrombosis, especially in the home. The greatest risk of not treating this disorder is the development of pulmonary embolism.⁷ There are about 500,000 cases of pulmonary embolism a year in the United States, resulting in more than 50,000 deaths.⁸ The risk of major bleeding from anticoagulation in patients with deep venous thrombosis has been said to be less than 10% and is usually associated with an underlying risk factor such as a recent operation or cancer.^{3,4} If bleeding or embolism occurs in a patient treated at home, physicians must be prepared to face possible medicolegal questions because the current standard of care is in-hospital care.

If home treatment is considered, an experienced home health care agency should be chosen so this approach can be implemented safely. A suitable home environment is also necessary (Table 1).

The case presented here illustrates an alternative treatment regimen for deep venous thrombosis confined to the calf and supporting rationale. A cost comparison of seven days of home treatment and seven days of hospital care (Table 2) reveals substantial savings. Because the safety of home treatment of calf thrombi has not been fully validated, a larger series of cases will be needed to further assess the appropriateness of this therapeutic option.

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